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Altaf Ahmad  
*Southern Illinois University*

Ronnie Q. Jia  
*Southern Illinois University*

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# Enterprise Systems and Intraorganizational Interdependence: A Task-Technology Fit Perspective

**Altaf Ahmad**

Southern Illinois University

[altaf@siu.edu](mailto:altaf@siu.edu)

**Ronnie Q. Jia**

Southern Illinois University

[ronnie@siu.edu](mailto:ronnie@siu.edu)

## ABSTRACT

Enterprise systems have the potential to bring immense benefits to organizations, but are often seen as falling short of that promise. This paper reports an on-going research project that relates the fit between enterprise systems and the nature of intraorganizational workflow interdependencies. Using task-technology fit theory, we propose that enterprise systems are best suited to organizations that possess primarily sequential interdependence between its units. We further contend that managing reciprocal interdependence through enterprise systems provides limited benefits and that managing complex interdependence (e.g., team interdependence) requires other types of systems. Contributions to enterprise system research and practice are discussed.

## Keywords

Enterprise systems, ERP, interdependence, coordination, task-technology fit

## INTRODUCTION

Through data integration and business process modifications, enterprise systems (ES) promise immense benefits to organizations. However, the expected benefits are not always realized (e.g., Davenport, Harris and Cantrell, 2004; Barua, Kriebel, and Mukhopadhyay, 1995). Because enterprise systems often require major workflow changes and are risky, it is worth understanding under which conditions enterprise system implementations are more likely to deliver benefits.

There has been substantial research on enterprise systems, such as work on implementation frameworks (e.g., Al-Mashari, Al-Mudimigh and Zairi, 2003; Robey, Ross, and Boudreau, 2002) and evaluation (e.g. Hitt, Wu and Zhou, 2002; Nicolaou, 2004). However, there has not been much work that links realized benefits with the patterns of interdependencies that exist in organizations, except for a few recent articles (e.g., Gattiker and Goodhue, 2005; Volkoff, Strong and Elmes, 2005). Gattiker and Goodhue (2005) hypothesized that the higher the intraorganizational interdependencies, the more performance gains the organization can reap from enterprise systems, and found support using a sample of manufacturing plants. However, their study, as noted by Volkoff et al. (2005), did not specify what type of interdependencies they considered, implying that such performance gains from enterprise systems could be realized in organizations with all forms of interdependencies.

This paper takes a task-technology fit perspective (Goodhue and Thompson, 1995) to investigate the fit between intraorganizational interdependencies and enterprise systems. Specifically, we argue that enterprise systems, as a coordination tool, are a better fit in organizations whose primary pattern of interdependence is sequential, as opposed to organizations primarily characterized by reciprocal (Thompson, 1967) or team interdependence (Van De Ven, Delbecq and Koenig, 1976). This is because reciprocal and team interdependencies are more complex workflow patterns and require coordination-related functionalities generally not available in enterprise systems. Thus, this paper's contribution lies in individually considering each of the different types of interdependencies vis-à-vis enterprise systems and in establishing that enterprise systems constitute the best fit with primarily sequential interdependence.

In the following sections, we will first review the existing literature on interdependence and coordination mechanisms, and then use task-technology fit perspective as a guide to develop hypotheses. Next, we present our data collection plans to test these hypotheses. We conclude by discussing the implications of this paper to research and practice.

## INTERDEPENDENCE AND COORDINATION MECHANISMS

Although Thompson's (1967) typology predates widespread adoptions of modern computing systems, it remains relevant today as it continues to contribute to research on various organizational phenomena (e.g., Kim, Umanth and Kim, 2005).

Thompson (1967) notes that organizations contain three types of interdependencies: pooled, sequential and reciprocal. Pooled interdependence occurs in a situation where "each part renders a discrete contribution to the whole and each is supported by the whole" (Thompson, 1967, p. 54), but does not imply a direct dependence on one unit by another. Sequential interdependence is serial in nature, with one unit dependent on the actions or output of another. Reciprocal interdependence refers to the situation in which "the outputs of each become inputs for the other" (Thompson, 1967, p. 55). Thompson also notes that the presence of higher level interdependence implies that of the lower ones.

The above types of interdependence correspond to three methods for coordination: standardization, coordination by plan, and coordination by mutual adjustment (Thompson, 1967). *Standardization* involves "establishment of routines or rules which constrain action of each unit into paths consistent with those taken by others" (Thompson, 1967, p. 56) and complements pooled interdependence. *Coordination by plan* involves "establishment of schedules for the interdependent units by which they may then be governed" (Thompson, 1967, p. 56) and is suited to sequential interdependence. Lastly, *coordination by mutual adjustment* involves "transmission of new information during the process of action" (Thompson, 1967, p. 56), and is suited to reciprocal interdependence. Because of the "distinct parallels between the three types of interdependence and the three types of coordination" (Thompson, 1967, p. 56), Thompson's discussion is consistent with the task-technology fit logic, which is discussed next.

## TASK-TECHNOLOGY FIT

Task-technology fit theory posits that a better fit between technology functionalities and task requirements will lead to better performance (Goodhue and Thompson, 1995). While the original theory focuses on individual performance, the notion of task-technology fit has been applied at higher levels of analyses (e.g., Maruping and Agarwal 2004, Ziguers and Buckland, 1998). Next, we use the task-technology fit logic to assess the fit between enterprise systems and the different types of workflow interdependence in relation to Gattiker and Goodhue's (2005) study.

## ENTERPRISE SYSTEM AND INTERDEPENDENCE

Using data from a sample of manufacturing plants, Gattiker and Goodhue (2005) concluded that the higher the intraorganizational interdependencies, the more performance gains the organization can reap from enterprise systems. However, their study did not specify the types of interdependencies considered (Volkoff et al., 2005), as if such performance gains from enterprise systems accrued to organizations with all types of interdependencies.

It is noted that Gattiker and Goodhue (2005) implicitly focused on sequential interdependence because their sampling was restricted to manufacturing plants, which most likely will display sequential interdependence. Thus, one may ask, what if the sample had included organizations with other patterns of interdependence, say, reciprocal. In other words, is the relationship linear, as Gattiker and Goodhue's conclusion implied, such that organizations dominated by reciprocal interdependence would reap more benefits than those with primarily sequential interdependence? We answer this and other pertinent questions in the next section and develop hypotheses for empirical testing.

## HYPOTHESIS DEVELOPMENT

In this section, we use the task-technology fit logic to examine enterprise systems as a coordination tool in helping organizations manage uncertainty associated with interdependence. The key question here is, "are all types of coordination mechanisms supported by enterprise systems?"

The three types of coordination place increasingly heavy burdens on communication and decision. Standardization requires less frequent decisions and a smaller volume of communication than does planning, and planning calls for less decision and communication activity than does mutual adjustment (Thompson, 1967).

Thompson suggests that pooled interdependence can be managed by standardization, and sequential interdependence can be coordinated through planning. Standardization is supported through data integration in enterprise systems, which use uniform data definitions and a common database, thus making well-structured data accessible to all (authorized) units. Standard data definitions and database rules introduce consistency and accurate data-keeping, e.g., full contact information is required of all supplier records. Planning is established in enterprise systems through linkages of various departments and business process integration, which reflects pre-programmed logic and rules, e.g., bill of materials. Thus, enterprise systems,

through data integration and business process integration, readily support coordination mechanisms such as standardization and planning.

Integration of various business processes introduces efficiencies in terms of time and effort spent as well as elimination of redundancies. For example, both accounting and purchasing departments work with the same supplier records, and one is able to see changes in supplier information made by the other. The immense benefits associated with integrating sequential activities extend to gaining reductions in inventory, reduced human capital requirements, etc. Thus, organizations characterized by sequential interdependence will realize more benefits than those with only pooled interdependence.

*H1: Everything else being equal, when enterprise systems are implemented in organizations with primarily sequential interdependence, there will be greater performance gains compared to those obtained by organizations with primarily pooled interdependence.*

As interdependence becomes more complex, it is increasingly difficult to coordinate because they contain higher degrees of contingency (Thompson, 1967). Unlike the unidirectional sequential dependence, units are restricted by each other's actions in reciprocal interdependence, and the organization faces a more variable and unpredictable internal environment. Therefore, as Thompson (1967) pointed out, reciprocal interdependence is most demanding of communication and decision effort and must be coordinated by mutual adjustment (p. 64).

Thompson recommended task-force and project groupings to resolve reciprocal interdependence. However, enterprise systems, with its roots in material requirement planning (MRP) software, do not have the functionalities that are available in group support systems to engender the kind of communication and exchange of ideas and information in these informal structures. In addition, task force and project groups often take on projects of various natures and are too dynamic for the rigid enterprise system. Thus, enterprise systems will not be a good fit for organizations dominated by reciprocal interdependence. When implemented, the performance gains will be less than those seen in organizations with primarily sequential interdependence.

*H2: Everything else being equal, when enterprise systems are implemented in organizations with primarily sequential interdependence, there will be greater performance gains compared to those obtained by organizations with primarily reciprocal interdependence.*

Van de Ven et al. (1976) added to Thompson's taxonomy by introducing team interdependence, which refers to the situation where a set of individuals work together at the same time with virtually no temporal difference in the actions of the members of the team. It is a "live" environment, where changes take place on the fly and responses to those changes also take place near-instantaneously. In such a situation, individuals require coordination through communication rather than the sharing of data that enterprise systems provide. However, enterprise systems, in general, are limited to providing basic message-based services, and are not meant to serve as the primary media of communication. Thus, enterprise systems is not a good fit for team interdependence settings and will not lead to significant performance gains. In addition, actors in team interdependence settings will also use alternate systems, such as group support systems, to support communication and task communication.

*H3: Actors in a team interdependence environment will use alternate systems (e.g., group support systems) beyond ERP to support communication and task coordination.*

## RESEARCH DESIGN

A survey is being planned to test the above hypotheses. It will target a wide range of industries to ensure a diverse sample of both manufacturing and non-manufacturing firms and to include all types of interdependencies. We will solicit participation from user associations and online user groups of major ERP packages and member organizations of U.S. Chamber of Commerce. The survey's respondents will be CIOs, who will be aware of the different systems in use as well as their overall impact. To account for any performance dip that may follow new ES implementations, time of implementation will be controlled for. The survey procedure will be similar to that of Gattiker and Goodhue (2005).

Respondents will be asked if their organization has implemented enterprise systems, and if so, the brand of the system. The survey will provide definitions of the three types of interdependence and ask the respondents to indicate the types present in their organizations as well as the dominant type of interdependence, which is the independent variable. To test H3, respondents who indicate the existence of team interdependence (Van de Ven et al., 1976) will be asked whether additional systems are used in the team setting besides enterprise systems. The dependent variable, i.e., business performance, will be measured by customary metrics from prior literature, such as return on assets, asset utilization, inventory turnover, etc. (Hitt et al., 2002). Public companies will be targeted to ensure wide availability of this data.

## SUMMARY AND CONTRIBUTIONS

Building on Thompson's (1976) taxonomies for interdependence and coordination mechanisms, we argue that as a coordination tool, enterprise systems is more appropriate for coordinating sequential than reciprocal interdependence. Therefore, from the task-technology fit perspective, we propose that organizations with primarily sequential interdependence will reap more benefits from enterprise systems utilization than those with primarily reciprocal interdependence. This paper extends the existing literature with a deeper understanding of the fit between different types of interdependence and the coordination mechanisms implied in enterprise systems, thus further clarifying the findings of Gattiker and Goodhue (2005). The anticipated findings will have clear implications for organizations contemplating ES implementation. Organizations characterized by primarily reciprocal or team interdependencies may not derive enough benefits to justify the costs and risks associated with enterprise systems implementation.

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